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ABSTRACT

This digest discusses to using spreadsheets in mathematics education. The case is made that being able to manage spreadsheets is an important skill in the technologically enhanced new millennium. An annotated list of World Wide Web resources is included. (MM)

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Digest

Using Spreadsheets in Mathematics Education

S. Asli Özgün-Koca

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Spreadsheets build an ideal bridge between arithmetic and algebra and allow the student free movement between the two worlds. Students look for patterns, construct algebraic expressions, generalize concepts, justify conjectures, and establish the equivalence of two models as intrinsic and meaningful needs rather than as arbitrary requirements posed by the teacher. (Friedlander, 1998, p. 383)

Electronic spreadsheets have been created and used mainly as tools for mathematical and statistical calculations, as numerical or textual data can be inserted into their columns and rows (http://wwwstaff.murdoch.edu.au/~kissane/spreadsheets.htm). So, being able to manage spreadsheets has become one of the skills sought for anybody in this technologically enhanced millennium. Therefore, spreadsheets have become an important part of many different curriculums at different levels of education. Moreover, they have been used in education, especially mathematics education, as a tool in helping students understand mathematical concepts such as plotting and exploring functions and patterns, exploring probability and statistics, mathematical modeling, and geometric transformations (http://www.freshpond.net/treasures/math/spreadsheet/default.htm). Relationships among different types of representations such as tables, equations and graphs are more easily comprehendible when all representations are visible at once (see Figure 1) and linked to each other, i.e. when one makes a change in one representation, corresponding changes in other representations are offered by the program. Moreover, spreadsheets allow students to focus on the mathematical reasoning by freeing them from the burden of calculations and algebraic manipulations.

Educational research supports the use of spreadsheets both in K-12 and teacher education and in professional development. Abramovich and Nabors (1997) describe how using spreadsheets helped seventh grade algebra students develop problem-solving skills. Molyneux-Hodgson et. al (1999) states that the results of their study "suggest the possibility of enhancing students' capability to shift between a wider range of representations using the modeling approach embedded in computer environments such as a spreadsheet" (p.1). Dudgale (1994) reports a project that involved experienced K-12 teachers in mathematical modeling and problem solving using spreadsheets and concludes that teachers developed models that exhibited a wide variety of mathematics topics and approaches in different grade levels.

National Council of Teachers of Mathematics (NCTM, 2000) suggests that "students in grades 3–5 should also become familiar with technological tools such as dynamic geometry software and spreadsheets. They should learn to set up a simple spreadsheet and use it to pose and solve problems, examine data, and investigate patterns" (p. 207). The use of spreadsheets for higher grade levels is also advocated by NCTM (2000): "The expanded class of functions available to high school students for mathematical modeling should provide them with a versatile and powerful means for analyzing and describing their world. With utilities for symbol manipulation, graphing, and curve fitting and with programmable software and spreadsheets to represent iterative processes, students can model and analyze a wide range of phenomena" (p. 297). NCTM published two books on the use of spreadsheets:

How To Use the Spreadsheet as a Tool in the Secondary School Mathematics Classroom. [Second Edition (for Windows and Macintosh Operating Systems)] by William J Masalski.

This book and accompanying two computer disks, one for Windows and one for Macintosh Operating Systems, presents 30 activities illustrating how computer spreadsheets can be used in the secondary school mathematics classroom.

Spreadsheet Activities in Middle School Mathematics by John Russell.

This book creates a problem-solving environment for middle grade students using the computerized spreadsheet. It offers instructional ideas and activities on number patterns, basic arithmetic, word problems, percents and probability.

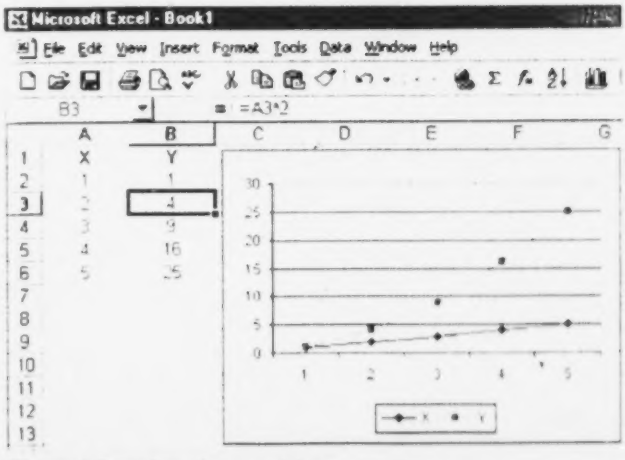

Figure 1 Snapshot of a spreadsheet

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World Wide Web Resources on Spreadsheets in Mathematics Education

Spreadsheets, Mathematics, Science, and Statistics Education by Erich Neuwirth

http://sunsite.univie.ac.at/Spreadsite/spreaded.html

Presents information about spreadsheets with an emphasis on mathematics and statistics education. Includes spreadsheets in education; recommended books; papers about spreadsheets in scientific journals and books; example spreadsheets and projects (mostly excel 5.0); and further resources for spreadsheets in education on the Internet.

Spreadsheets in the Math Class

http://www.math.byu.edu/~lfrancis/readings302/Spreadsheets.html#TOC

Discusses NCTM's position statements on technology, the definition of and benefits of using a spreadsheet, data analysis ideas from the real world, and sample activities to introduce spreadsheets to students.

Spreadsheet Projects for the Middle School Math Curriculum

http://www.parktudor.pvt.k12.in.us/Sosenke/nctm2000.htm

Lists the advantages of the spreadsheets and stages in working with spreadsheets. Presents a seventh grade spreadsheet unit, independent short projects, interdisciplinary projects, and references on the use of spreadsheets in the mathematics classroom.

Resources for Mathematics Educators: Spreadsheets in Mathematics

http://www.freshpond.net/treasures/math/spreadsheet/default.htm

Discusses the benefits of using spreadsheets in mathematics teaching and some of the particular areas in which spreadsheets can be useful in teaching and learning math. Provides a list of web sites that provide information on using spreadsheets in mathematics classrooms.

Introduction to Math and Spreadsheets

http://forum.swarthmore.edu/sum95/math_and/spreadsheets/intro.html

Provides a variety of math exercises utilizing spreadsheets.

Spreadsheets in Mathematics

http://jwilson.coe.uga.edu/Allison/Spreadsheet%20home%20page

Discusses the reasons for using spreadsheets in math classrooms. Provides information on how to create a spreadsheet, enter data, copy cells and formulas, and graph. Presents problem sets for elementary, middle, and high school mathematics.

The Use of Spreadsheets in Mathematics Teaching

http://www.geocities.com/teddy_mutadi/essay_EME717.html

This essay discusses the possible application of spreadsheets in an Indonesian curriculum setting. It also highlights the advantages and disadvantages of utilizing spreadsheets in school mathematics.

Spreadsheet-Based Tool Kit For Modeling Concepts In Elementary Number Theory by Sergei Abramovich and Andrew Brantlinger

http://forum.swarthmore.edu/clime/961.html

This paper presents pedagogical ideas concerning the use of a spreadsheet-based tool kit for modeling several structures and concepts in elementary number theory such as Pythagorean triples, sums of perfect powers, multiple representations of integers, the Euclidean algorithm, and the Euler phi-function.

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Finding More Resources

To find more resources on this topic, search the ERIC database online (http://ericir.syr.edu/Eric/) and use various combinations of the following descriptors:

Set 1: spreadsheets, tables (data)

Set 2: mathematics, mathematics activities, mathematics education, mathematics instruction, teaching methods

Set 3: elementary education, secondary education, elementary secondary education, postsecondary education, adult education

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